

Probing mechanism of evolution of simple genomes

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Our overarching goal is to discover how the structure of the genotypic space of RNA polymers affects their ability to evolve. Specifically, we will address several fundamental questions that, so far, have remained largely unanswered. Was the genotypic space explored globally or only locally? Was the outcome of early evolution predictable or was it, instead, governed by chance? What was the role of neutral mutations in the evolution of increasing complex systems? As the first step, we study the problem in the example of RNA ligases. We obtain the complete, empirical fitness landscapes for short ligases and examine possible evolutionary paths for RNA molecules that are sufficiently long to preclude exhaustive search of the genotypic space.